Gulf of Alaska Play 3: Yakutat Shelf-Basal Yakataga FormationPlay

Geological Assessment

GRASP UAI: AAAAA EAE
Play Area: 7,600 square miles
Play Water Depth Range: 130-1,530 feet
Play Depth Range: 3,700-13,000 feet
Play Exploration Chance: 0.2015

Play 3, Yakutat Shelf-Basal Yakataga Formation, Gulf of Alaska OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil & Gas			
Assessment Results as of November 2005			
Resource Commodity (Units)	Resources *		
	F95	Mean	F05
BOE (Mmboe)	0	221	752
Total Gas (Tcfg)	0.000	0.606	2.097
Total Liquids (Mmbo)	0	113	379
Free Gas** (Tcfg)	0.000	0.513	1.786
Solution Gas (Tcfg)	0.000	0.093	0.311
Oil (Mmbo)	0	86	287
Condensate (Mmbc)	0	27	92

** Risked, Technically-Recoverable*
*** Free Gas Includes Gas Cap and Non-Associated Gas*
F95 = 95% chance that resources will equal or exceed the given quantity
F05 = 5% chance that resources will equal or exceed the given quantity
BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas
Mmb = millions of barrels
Tcf = trillions of cubic feet

Table 1

Play 3, the "Yakutat Shelf-Basal Yakataga Formation" play, is the third most important play (of six plays) in the Gulf of Alaska OCS Planning Area, with 15% of the Planning Area energy endowment (1,454 Mmboe). At 7,600 square miles, it is the largest in area of all six plays. The overall assessment results for play 3 are shown in table 1. Oil and gas-condensate liquids form 51% of the hydrocarbon energy endowment of play 3. Table 5 reports the detailed assessment results by commodity for play 3.

Table 3 summarizes the volumetric input data developed for the *GRASP* computer model of Gulf of Alaska play 3. Table 4 reports the risk model used for play 3. The location of play 3 is shown in figure 1.

This play encompasses the area from the Pamplona zone southeastward to just west of Cross Sound. There are a few large structural highs mapped in the area, but traps are mainly inferred to be stratigraphic and combination structural-stratigraphic in nature. These traps contain reservoir sandstones of the basal Yakataga and uppermost Poul Creek Formations and are speculated to consist of up-dip pinchouts, basement onlap, lateral facies transitions, and up-dip truncations against normal faults.

Two potential source rock units have been identified for play 3: 1) Eocene rocks of the nonmarine to deltaic Kulthieth Formation and its deeper marine equivalent facies; and 2) middle to upper Miocene rocks of the upper Poul Creek Formation. Oil has been encountered at several onshore seeps and well sites, including the oil at the Katalla field. However, the organically richest potential source, the Miocene Poul Creek Formation, is thermally immature where encountered in offshore wells. Potential source rocks of Eocene age are mature offshore only where very deeply buried. Source intervals are deeply buried with moderate to relatively high thermal maturity in the northwest, becoming shallower with decreasing maturity to the south and east. The ARCO Y-0211 (Yakutat No. 1) well

(fig. 1) tested the largest mapped structure in the play area and recorded minor oil shows.

Play 3, Yakutat Shelf-Basal Yakataga Formation, Gulf of Alaska OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools			
Assessment Results as of November 2005			
Pool Rank	BOE Resources *		
	F95	Mean	F05
1	24	211	806
2	11	66	168
3	6.2	36	97
4	3.5	23	60
5	2.2	16	42
6	1.45	12	31
7	1.07	9	24
8	0.84	7	19
9	0.69	6	16
10	0.59	5	13

** Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file*

F95 = 95% chance that resources will equal or exceed the given quantity

F05 = 5% chance that resources will equal or exceed the given quantity

BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas

Table 2

A maximum of 32 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 3. These 32 pools range in mean conditional (un-risked) recoverable volumes from 0.7 Mmboe (pool rank 32) to 211 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 24 Mmboe (F95) to 806 Mmboe (F05), or in a gas case from 0.135 Tcfge (F95) to 4.53 Tcfge (F05). Table 2 shows the conditional sizes of the 10 largest pools in play 3.

In the computer simulation for play 3 a total of 60,070 “simulation pools” were sampled for size. These simulation pools can be grouped according to the USGS size class system in which sizes double with each successive class. Pool size class 9 contains the largest share (11,368, or 19%) of simulation pools (conditional, technically recoverable BOE resources) for play 3. Pool size class 9 ranges from 8 to 16 Mmboe. The largest simulation pool for play 3 falls within pool size class 17, which ranges in size from 2,048 to 4,096 Mmboe (or 11.5 to 23 Tcfge). Table 6 reports statistics for the simulation pools developed in the *GRASP* computer model for play 3.

GRASP Play Data Form (Minerals Management Service - Alaska Regional Office)

Basin: Gulf of Alaska
Play Number: 3
Play UAI Number: AAAAAEAE

Assessor: Comer / Larson
Play Name: Yakutat Shelf - Basal Yakataga Formation

Date: March, 2005

Play Area (mi^2; millions of acres): 7,600 mi^2, 4.864 million acres
Reservoir Thermal Maturity, % Ro: 0.2 - 0.6 +

Play Depth Range, feet: 3,700 - 6,900 - 13,000
Expected Oil Gravity, ^{o} API: 35
Play Water Depth Range, feet: 130 - 440 - 1530
Prospect Distance from shore, miles: 5 - 14 - 39

POOLS Module (Volumes of Pools, Acre-Feet)

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Prospect Area (acres)-Model Input	0				2800	~~~					24000		~
Prospect Area (acres)-Model Output	100	501	733	1383	2800	4839.4 / 6822.0	5670	8280	10700	15647	24000	31920	48000
Fill Fraction (Fraction of Area Filled)	0.08	0.158	0.182	0.23	0.3	0.32386 / 0.13171	0.391	0.45	0.495	0.571	0.67	0.745	0.95
Productive Area of Pool (acres)	12	134	204	416	915	1852.48 / 3150.86	2013	3074	4094	6262	10100	13891	40400
Pay Thickness (feet)	5	28	37	59	100	137.301 / 131.204	170	225	273	363	500	619	1844

MPRO Module (Numbers of Pools)

Play Level Chance	0.65	Prospect Level Chance	0.31	Exploration Chance	0.2015

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		[See Risking Sheet]	

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	12	20	21	24	29	29.81 / 6.90	33	36	38	42	46	49	67
Numbers of Pools in Play	~	~	F64.99 = 0	F60 = 5	7	6.01 / 5.15	10	11	13	14	16	17	32

Minimum Number of Pools	0	Mean Number of Pools	6.01	Maximum Number of Pools	32

POOLS/PSRK/PSUM Module (Play Resources)

Fractile	F100	F95	F90	F75	F50	Mean / Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	34	78	90	115	150	162.591 / 68.468	196	226	250	288	339	378	658
Gas Recovery Factor (Mcfg/acre-foot)	41	153	192	280	428	523.895 / 374.241	653	820	956	1200	1551	1840	4410
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	370	574	652	806	1020	1084.433 / 391.616	1291	1465	1596	1813	2091	2300	2900
Condensate Yield ((bbl/Mmcfg)	20	40	42	47	52	52.646 / 8.460	58	61	64	67	72	75	100

Pool Size Distribution Statistics from *POOLS* (1,000 BOE): **μ (mu) =** 9.42721954 **σ^2 (sigma squared) =** 2.16727203 **Random Number Generator Seed =** 692292

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	1
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.65
Probability Any Pool is 100% Gas	0		

Table 3. Input data for Gulf of Alaska play 3, 2006 assessment.

Risk Analysis Form - 2005 National Assessment

Assessment Province:	Gulf of Alaska	**Play Number, Name:**	3, Yakutat Shelf-Basal Yakataga
Assessor(s):	Comer & Larson	**Play UAI:**	AAAAAEAE
Date:	13-Oct-05		

For each component, a *quantitative* probability of success (i.e., between zero and one, where zero indicates no confidence and one indicates absolute certainty) based on consideration of the *qualitative* assessment of **ALL** elements within the component was assigned. This is the assessment of the probability that the minimum geologic parameter assumptions have been met or exceeded.

			Play Chance Factors	Averge Conditional Prospect Chance[1]
1.	**Hydrocarbon Fill component** (1a * 1b * 1c)	**1**	***0.6500***	***0.6500***
	a. Presence of a Quality, Effective, Mature Source Rock			
	Probability of efficient source rock in terms of the existence of sufficient volume of mature source rock of adequate quality located in the drainage area of the reservoirs.	1a	1.00	0.65
	b. Effective Expulsion and Migration			
	Probability of effective expulsion and migration of hydrocarbons from the source rock to the reservoirs.	1b	0.65	1.00
	c. Preservation			
	Probability of effective retention of hydrocarbons in the prospects after accumulation.	1c	1.00	1.00
2.	**Reservoir component** (2a * 2b)	**2**	***1.0000***	***0.6800***
	a. Presence of reservoir facies			
	Probability of presence of reservoir facies with a minimum net thickness and net/gross ratio (as specified in the resource assessment).	2a	1.00	0.85
	b. Reservoir quality			
	Probability of effectiveness of the reservoir, with respect to minimum effective porosity, and permeability (as specified in the resource assessment).	2b	1.00	0.80
3.	**Trap component** (3a * 3b)	**3**	***1.0000***	***0.7000***
	a. Presence of trap			
	Probability of presence of the trap with a minimum rock volume (as specified in the resource assessment).	3a	1.00	0.70
	b. Effective seal mechanism			
	Probability of effective seal mechanism for the trap.	3b	1.00	1.00

Overall Play Chance (Marginal Probability of hydrocarbons, MPhc)	***0.6500***	
(1 * 2 * 3) *Product of All Subjective Play Chance Factors*		
Average Conditional Prospect Chance[1]		***0.3094***
(1 * 2 * 3) *Product of All Subjective Conditional Prospect Chance Factors*		
[1] Assumes that the Play exists (where all play chance factors = 1.0)		
Must be consistent with play chance and prospect distribution -- See discussion on Page 3 of Guide		
Exploration Chance	***0.2011***	
(Product of Overall Play Chance and Average Conditional Prospect Chance)		

Comments: *See guidance document for explanation of the Risk Analysis Form*

Table 4. Risk model for Gulf of Alaska play 3, 2006 assessment.

GRASP - Geologic and Economic Resource Assessment Model - PSUM Module Results

Minerals Management Service - Alaska OCS Region
GRASP Model Version: 8.29.2005)
Computes the Geologic Resource Potential of the Play

Play UAI:	**AAAAAEAE**		**Play No.**		**3**	
World	Level	-	World	Level	Resources	
Country	Level	-	UNITED	STATES	OF	AMERICA
Region	Level	-	MMS	-	ALASKA	REGION
Basin	Level	-	**GULF**	**OF**	**ALASKA**	
Play	**Level**	**-**	**Play No. 3**	**Yakutat Shelf - Basal Yakataga Formation**		
Geologist	Larson,	Comer				
Remarks	Play		3 Yakutat	Shelf;		
Run Date & Time:		Date	19-Sep-05	Time	14:03:11	

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	220,780	308,270
Oil (Mbo)	85,956	119,790
Condensate (Mbc)	26,997	41,317
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	513,250	781,030
Solution Gas (Mmcfg)	92,725	132,330

10000 (Number of Trials in Sample)
0.6497 (MPhc [Probability] of First Occurrence of Non-Zero Resource)
Windowing Feature: used

Empirical Probability Distributions of the Products

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Free (Gas Cap & Nonassociated) Gas (Mmcfg)	Solution Gas (Mmcfg)
100	0	0	0	0	0
99.99	0	0	0	0	0
99	0	0	0	0	0
95	0	0	0	0	0
90	0	0	0	0	0
85	0	0	0	0	0
80	0	0	0	0	0
75	0	0	0	0	0
70	0	0	0	0	0
65	7,268	3,047	816	15,691	3,447
60	73,859	29,957	8,641	165,670	32,497
55	110,940	45,054	13,179	248,110	48,133
50	142,770	56,946	17,165	324,500	61,376
45	173,230	71,075	20,170	384,890	75,864
40	202,630	80,611	24,218	460,740	88,927
35	237,360	97,116	27,476	527,950	105,790
30	273,110	106,440	33,608	635,990	111,770
25	314,830	121,950	38,923	734,090	131,150
20	370,960	145,770	44,780	850,330	163,530
15	440,040	175,540	52,495	999,220	192,290
10	548,590	212,450	67,412	1,275,400	234,900
8	613,750	234,270	76,032	1,459,300	246,040
6	692,310	278,560	81,647	1,576,200	290,210
5	751,850	286,870	91,822	1,785,900	311,260
4	816,710	313,210	100,650	1,920,300	343,740
2	1,054,000	395,130	130,660	2,531,300	437,350
1	1,397,700	541,070	169,310	3,285,500	577,180
0.1	3,154,000	1,623,900	307,840	5,146,300	1,723,200
0.01	4,359,700	898,080	711,880	14,458,000	995,070
0.001	4,596,800	1,786,000	570,510	10,475,000	2,116,100

Table 5. Assessment results by commodity for Gulf of Alaska play 3, 2006 assessment.

Basin: GULF OF ALASKA
Play 03 - Yakutat Shelf- Basal Yakataga Formation
UAI Key: AAAAAEAE

Model Simulation "Pools" Reported by "Fieldsize.out" *GRASP* Module

Classification and Size				Pool Count Statistics				Pool Types Count			Mixed Pool Range		Oil Pool Range		Gas Pool Range		Total Pool Range			Pool Resource Statistics (MMBOE)			
Class	Min (MMBOE)	Max (MMBOE)	Pool Count	Percentage	Trial Average	Trials w/Pool Avg		Mixed Pool	Oil Pool	Gas Pool	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Total Resource	Average Resource
1	0.0312	0.0625	14	0.023306	0.0014	0.002155		14	0	0	1	1	0	0	0	0	1	1		0.040595	0.062234	0.753571	53.826500
2	0.0625	0.125	43	0.071583	0.0043	0.006617		43	0	0	1	1	0	0	0	0	1	1		0.063120	0.124127	4.148077	96.466906
3	0.125	0.25	195	0.324621	0.0195	0.030009		195	0	0	1	2	0	0	0	0	1	2		0.126453	0.248789	37.389938	191.743270
4	0.25	0.5	586	0.975529	0.0586	0.090182		586	0	0	1	2	0	0	0	0	1	2		0.250634	0.499978	225.513966	384.836107
5	0.5	1	1724	2.869985	0.1724	0.265312		1724	0	0	1	3	0	0	0	0	1	3		0.500407	0.999323	1316.727000	763.762474
6	1	2	3809	6.340936	0.3809	0.58618		3809	0	0	1	6	0	0	0	0	1	6		1.000558	1.999704	5719.997000	1.501706
7	2	4	6956	11.579823	0.6956	1.070483		6956	0	0	1	7	0	0	0	0	1	7		2.000191	3.999422	20682.969000	2.973400
8	4	8	9603	15.986349	0.9603	1.477839		9603	0	0	1	8	0	0	0	0	1	8		4.000377	7.999720	56420.698000	5.875320
9	8	16	11368	18.924587	1.1368	1.749461		11368	0	0	1	8	0	0	0	0	1	8		8.000913	15.998354	131473.210000	11.565202
10	16	32	10479	17.444649	1.0479	1.61265		10479	0	0	1	9	0	0	0	0	1	9		16.000425	31.990468	238262.386000	22.737129
11	32	64	7508	12.498752	0.7508	1.155432		7508	0	0	1	8	0	0	0	0	1	8		32.005635	63.994750	337944.322000	45.011231
12	64	128	4441	7.393042	0.4441	0.683441		4441	0	0	1	5	0	0	0	0	1	5		64.005437	127.996351	395181.367000	88.984772
13	128	256	2113	3.517563	0.2113	0.325177		2113	0	0	1	6	0	0	0	0	1	6		128.068436	255.986456	370972.829000	175.566879
14	256	512	820	1.365074	0.082	0.126193		820	0	0	1	2	0	0	0	0	1	2		256.682827	510.522274	283931.021000	346.257355
15	512	1024	316	0.526053	0.0316	0.04863		316	0	0	1	2	0	0	0	0	1	2		512.789585	1013.767000	215943.173000	683.364502
16	1024	2048	75	0.124854	0.0075	0.011542		75	0	0	1	2	0	0	0	0	1	2		1030.228000	1973.077000	103773.456000	1.383646
17	2048	4096	16	0.026636	0.0016	0.002462		16	0	0	1	1	0	0	0	0	1	1		2070.454000	3859.600000	45895.343000	2.868459
18	4096	8192	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
19	8192	16384	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
20	16384	32768	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
21	32768	65536	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
22	65536	131072	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
23	131072	262144	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
24	262144	524288	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
25	524288	1048576	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
Not Classified			4	0.006659	0.0004	0.000616	Below Class	4	0	0									Below Class	0.021217	0.028665	0.099415	24.853695
		Totals	**60070**	**100**	**6.007**	**9.244384**	Above Class	0	0	0									Above Class	0.000000	0.000000	0.000000	0.000000

Number of Pools not Classified: 4
Number of Pools below Class 1: 4
Number of Trials with Pools: 6498

Min and Max refer to numbers of pools of the relevant size class that occur within any single trial in the simulation.

Min and Max refer to aggregate resources of the relevant size class that occur within any single trial in the simulation.

Table 6. Statistics for simulation pools created in computer sampling run for Gulf of Alaska play 3, 2006 assessment.

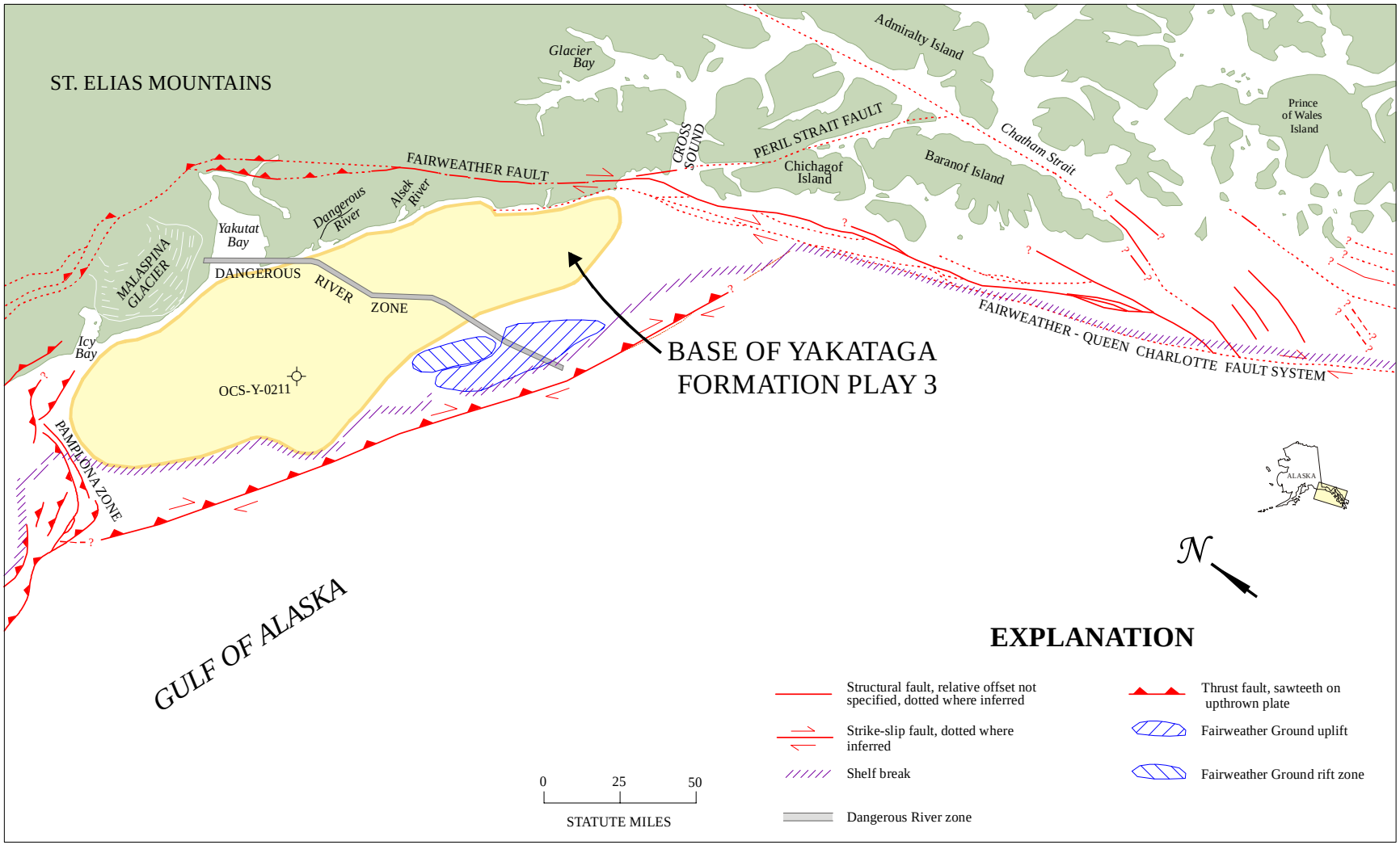

Figure 1. Map location of Gulf of Alaska play 3, 2006 assessment.